

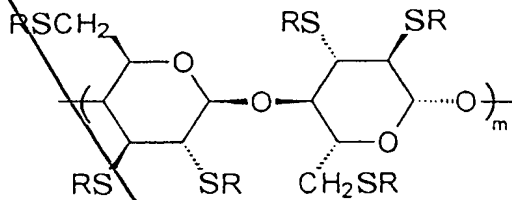
WHAT IS CLAIMED IS

1. A liquid crystal display device, comprising:

first and second substrates;

a first alignment layer on the first substrate,

wherein the first alignment layer includes



(spacer S is oxygen, m = 10~10,000),

the functional group R includes at least one of a group consisting of photo-sensitive constituents and non-photo-sensitive constituents, the photo-sensitive

constituents include a material selected from the group

consisting of cinnamoyl derivatives, the non-photo-

sensitive constituents include a material selected from

the group consisting of C<sub>n</sub>H<sub>2n</sub>, C<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n</sub>OH, COC<sub>n</sub>H<sub>2n+1</sub>,

COC<sub>n</sub>H<sub>2n</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, C<sub>n</sub>H<sub>2n-(x-1)</sub>F<sub>(x-1)</sub>, C<sub>n</sub>H<sub>2n-x</sub>F<sub>x</sub>OH, COC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub> (n

= 1~10, x = 1~2n+1), and a combination thereof; and

a liquid crystal layer between the first and second

substrate.

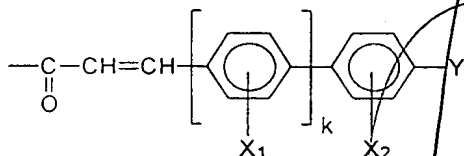
1 2. The liquid crystal display device according to claim  
2 1, further comprising a second alignment layer on the  
3 second substrate.

1 3. The liquid crystal display device according to claim  
2 2, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
6 polyamic acid and silicone dioxide.

1 4. The liquid crystal display device according to claim  
2 2, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

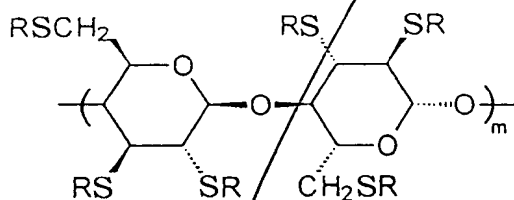
1 5. The liquid crystal display device according to claim  
2 1, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $\text{NO}_2$ ,  $\text{CH}_3$ ,  $\text{OCH}_3$ ,  $\text{CF}_3$ ,  $\text{OCF}_3$ ,  $\text{C}_n\text{H}_{2n+1}$ ,  
5  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_6\text{H}_5$ ,  $\text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1\sim 10$ ,  $x$   
6  $= 1\sim 2n+1$ ).

- 1 6. The liquid crystal display device according to claim  
2 1, wherein the cinnamoyl derivative is



- 3  
4 (X<sub>1</sub> and X<sub>2</sub> are each selected from the group consisting  
5 of hydrogen, fluorine, chlorine, CN, NO<sub>2</sub>, CH<sub>3</sub>, OCH<sub>3</sub>, CF<sub>3</sub>,  
6 OCF<sub>3</sub>; k is 0 to 1; Y is selected from the group consisting  
7 of hydrogen, fluorine, chlorine, cyano, NO<sub>2</sub>, CF<sub>3</sub>, OCF<sub>3</sub>,  
8 C<sub>n</sub>H<sub>2n+1</sub>, OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, OC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub> (n = 1~10, x =  
9 1~2n+1)).

- 1 7. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 a first alignment layer on the first substrate,  
4 wherein the first alignment layer includes



- 5  
6 (spacer S is sulfur, m = 10~10,000),  
7 the functional group R includes at least one of a  
8 group consisting of photo-sensitive constituents and non-  
9 photo-sensitive constituents; and  
10 a liquid crystal layer between the first and second

11 substrates.

1 8. The liquid crystal display device according to claim  
2 7, further comprising a second alignment layer on the  
3 second substrate.

1 9. The liquid crystal display device according to claim  
2 8, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
6 polyamic acid and silicone dioxide.

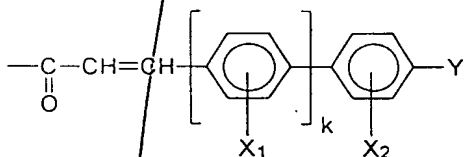
1 10. The liquid crystal display device according to claim  
2 8, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

1 11. The liquid crystal display device according to claim  
2 7, wherein the photo-sensitive constituent includes a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

1 12. The liquid crystal display device according to claim  
2 7, wherein the non-photo-sensitive constituents include a  
3 material selected from the group consisting of H,  $C_nH_{2n}$ ,  
4  $C_nH_{2n+1}$ ,  $C_nH_{2n}OH$ ,  $COC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}OH$ ,  $COC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a  
5 combination thereof.  
6

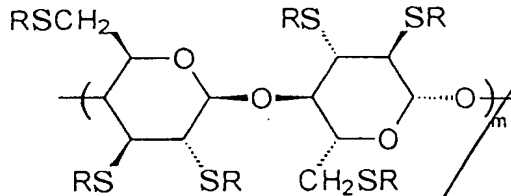
1 13. The liquid crystal display device according to claim  
2 11, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,  
5  $OC_nH_{2n+1}$ ,  $C_6H_5$ ,  $C_6H_4OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x$   
6  $= 1 \sim 2n+1$ ).

1 14. The liquid crystal display device according to claim  
2 11, wherein the cinnamoyl derivative is



4 ( $X_1$  and  $X_2$  are each selected from the group consisting  
5 of hydrogen, fluorine, chlorine, CN,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  
6  $OCF_3$ ;  $k$  is 0 to 1;  $Y$  is selected from the group consisting  
7 of hydrogen, fluorine, chlorine, cyano,  $NO_2$ ,  $CF_3$ ,  $OCF_3$ ,  
8  $C_nH_{2n+1}$ ,  $OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x =$   
9  $1 \sim 2n+1$ )).

1 15. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 a first alignment layer on the first substrate,  
4 wherein the first alignment layer includes



6 (spacer S is NH, m = 10~10,000),  
7 the functional group R includes at least one of a  
8 group consisting of photo-sensitive constituents and non-  
9 photo-sensitive constituents; and  
10 a liquid crystal layer between the first and second  
11 substrates.

1 16. The liquid crystal display device according to claim  
2 15, further comprising a second alignment layer on the  
3 second substrate.

1 17. The liquid crystal display device according to claim  
2 16, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,

6 polyamic acid and silicone dioxide.

1 18. The liquid crystal display device according to claim  
2 16, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

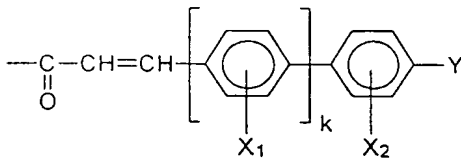
1 19. The liquid crystal display device according to claim  
2 15, wherein the photo-sensitive constituents include a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

1 20. The liquid crystal display device according to claim  
2 15, wherein the non-photo-sensitive constituents include a  
3 material selected from the group consisting of H,  $C_nH_{2n}$ ,  
4  $C_nH_{2n+1}$ ,  $C_nH_{2n}OH$ ,  $COC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}$ ,  $C_nH_{2n-(x-1)}F_{x-1}OH$ ,  $COC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a  
5 combination thereof.  
6

1 21. The liquid crystal display device according to claim  
2 19, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,

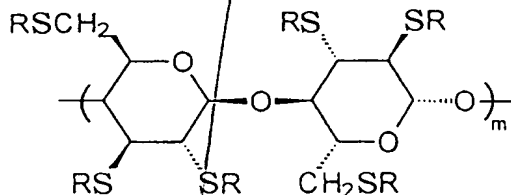
5  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_6\text{H}_5$ ,  $\text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1\sim 10$ ,  $x$   
6  $= 1\sim 2n+1$ ).

1 22. The liquid crystal display device according to claim  
2 19, wherein the cinnamoyl derivative is



4 ( $\text{X}_1$  and  $\text{X}_2$  are each selected from the group consisting  
5 of hydrogen, fluorine, chlorine, CN,  $\text{NO}_2$ ,  $\text{CH}_3$ ,  $\text{OCH}_3$ ,  $\text{CF}_3$ ,  
6  $\text{OCF}_3$ ;  $k$  is 0 to 1;  $\text{Y}$  is selected from the group consisting  
7 of hydrogen, fluorine, chlorine, cyano,  $\text{NO}_2$ ,  $\text{CF}_3$ ,  $\text{OCF}_3$ ,  
8  $\text{C}_n\text{H}_{2n+1}$ ,  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1\sim 10$ ,  $x =$   
9  $1\sim 2n+1$ )).

1 23. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 a first alignment layer on the first substrate,  
4 wherein the first alignment layer includes



6 (spacer  $\text{S}$  is  $\text{OC}_h\text{H}_{2h}$  ( $h = 1\sim 5$ ),  $m = 10\sim 10,000$ ),  
7 the functional group  $\text{R}$  includes at least one of a



8 group consisting of photo-sensitive constituents and non-  
9 photo-sensitive constituents; and  
10 a liquid crystal layer between the first and second  
11 substrates.

1 24. The liquid crystal display device according to claim  
2 23,

3 further comprising a second alignment layer on the  
4 second substrate.

1 25. The liquid crystal display device according to claim  
2 24, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
6 polyamic acid and silicone dioxide.

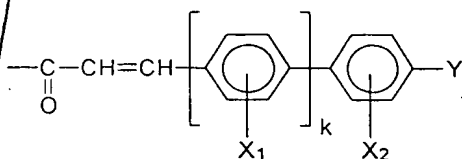
1 26. The liquid crystal display device according to claim  
2 24, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

1 27. The liquid crystal display device according to claim  
2 23, wherein the photo-sensitive constituents include a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

1 28. The liquid crystal display device according to claim  
2 23, wherein the non-photo-sensitive constituents include a  
3 material selected from the group consisting of H,  $\text{OC}_n\text{H}_{2n}$ ,  
4  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{COC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n}\text{OH}$ ,  $\text{OC}_n\text{H}_{2n}\text{OH}$ ,  $\text{OCOC}_n\text{H}_{2n+1}$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$ ,  
5  $\text{OC}_n\text{H}_{2n-(x-1)}\text{F}_{(x-1)}$ ,  $\text{C}_n\text{H}_{2n-(x-1)}\text{F}_{(x-1)}\text{OH}$ ,  $\text{OC}_n\text{H}_{2n-(x-1)}\text{F}_{x-1}\text{OH}$ ,  $\text{COC}_n\text{H}_{2n+1-}$   
6  $x\text{F}_x$ ,  $\text{OCOC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a combination  
7 thereof.

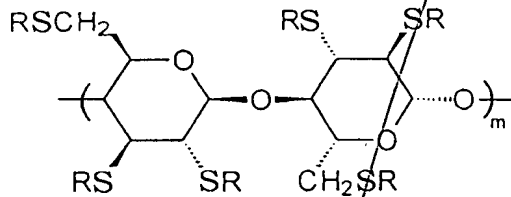
1 29. The liquid crystal display device according to claim  
2 27, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $\text{NO}_2$ ,  $\text{CH}_3$ ,  $\text{OCH}_3$ ,  $\text{CF}_3$ ,  $\text{OCF}_3$ ,  $\text{C}_n\text{H}_{2n+1}$ ,  
5  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_6\text{H}_5$ ,  $\text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1 \sim 10$ ,  $x$   
6  $= 1 \sim 2n+1$ ).

1 30. The liquid crystal display device according to claim  
2 27, wherein the cinnamoyl derivative is



4 (X<sub>1</sub> and X<sub>2</sub> are each selected from the group consisting  
5 of hydrogen, fluorine, chlorine, CN, NO<sub>2</sub>, CH<sub>3</sub>, OCH<sub>3</sub>, CF<sub>3</sub>,  
6 OCF<sub>3</sub>; k is 0 to 1; Y is selected from the group consisting  
7 of hydrogen, fluorine, chlorine, cyano, NO<sub>2</sub>, CF<sub>3</sub>, OCF<sub>3</sub>,  
8 C<sub>n</sub>H<sub>2n+1</sub>, OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, OC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub> (n = 1~10, x =  
9 1~2n+1)).

1 31. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 a first alignment layer on the first substrate,  
4 wherein the first alignment layer includes



5  
6 (spacer S is OC<sub>n</sub>H<sub>2n</sub>O (h = 1~5), m = 10~10,000),  
7 the functional group R includes at least one of a  
8 group consisting of photo-sensitive constituents and non-  
9 photo-sensitive constituents; and  
10 a liquid crystal layer between the first and second  
11 substrates.

1 32. The liquid crystal display device according to claim  
2 31,  
3 further comprising a second alignment layer on the

4 second substrate.

1 33. The liquid crystal display device according to claim  
2 32, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
6 polyamic acid and silicone dioxide.

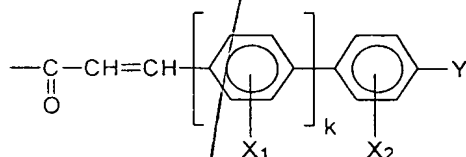
1 34. The liquid crystal display device according to claim  
2 32, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

1 35. The liquid crystal display device according to claim  
2 31, wherein the photo-sensitive constituents include a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

1 36. The liquid crystal display device according to claim  
2 31, wherein the non-photo-sensitive constituents include a  
3 material selected from the group consisting of H,  $C_nH_{2n}$ ,  
4  $C_nH_{2n+1}$ ,  $C_nH_{2n}OH$ ,  $COC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}$ ,  $C_nH_{2n-(x-1)}F_{x-1}OH$ ,  $COC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a  
5 combination thereof.  
6

1 37. The liquid crystal display device according to claim  
2 35, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,  
5  $OC_nH_{2n+1}$ ,  $C_6H_5$ ,  $C_6H_4OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x$   
6  $= 1 \sim 2n+1$ ).

1 38. The liquid crystal display device according to claim  
2 35, wherein the cinnamoyl derivative is



3  
4 ( $X_1$  and  $X_2$  are each selected from the group consisting of  
5 hydrogen, fluorine, chlorine, CN,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ;  
6  $k$  is 0 to 1;  $Y$  is selected from the group consisting of  
7 hydrogen, fluorine, chlorine, cyano,  $NO_2$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,  
8  $OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ )).

1 39. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 an alignment layer on the first substrate, wherein  
4 the alignment layer includes a cellulose, a derivative of  
5 a cinnamoyl group and a spacer between a main polymer  
6 chain and the derivative of the cinnamoyl group; and  
7 a liquid crystal layer between the first and second  
8 substrates.

1 40. The liquid crystal display device according to claim  
2 39, wherein the derivative of the cinnamoyl group includes  
3 at least one member selected from the group consisting of  
4 hydrogen, fluorine, chlorine, cyano, NO<sub>2</sub>, CH<sub>3</sub>, OCH<sub>3</sub>, CF<sub>3</sub>,  
5 OCF<sub>3</sub>, C<sub>n</sub>H<sub>2n+1</sub>, OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>6</sub>H<sub>5</sub>, C<sub>6</sub>H<sub>4</sub>OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, OC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>  
6 (n = 1~10, x = 1~2n+1).

1 41. The liquid crystal display device according to claim  
2 39, wherein the spacer includes at least one member  
3 selected from the group consisting of oxygen, sulfur, NH,  
4 OC<sub>n</sub>H<sub>2h</sub>, OC<sub>n</sub>H<sub>2h</sub>O (h = 1~5).

1 42. The liquid crystal display device according to claim  
2 39, wherein the alignment layer is divided into at least  
3 two domains to drive differently liquid crystal molecules

4 in the liquid crystal layer on each domain.

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